STRATAGEM974
Engineering & Consulting Firm
62 bd du Chaudron
97490 Sainte Clotilde
Tél/fax : 0262 21 84 69
GSM : 0692 26 60 62 / 0692 36 96 50
Courriel : contact@stratagem974.com

DETECTION OF BURIED PIPES THANKS TO ELECTROMAGNETIC METHODS

Context

Installing new networks such as optic-fibre or water pipes is a risky operation, because of the existing pipes or cables already present in the ground (electrical, telephonic, gas, water conveyance, sewage disposal, etc.). These existing networks must be taken into account in order to prevent workers and public from accidents and to avoid useless expenses.

Even though there are maps of these existing networks, lots of accidents happen each year because of their lack of precision.

Solutions

Ground Penetrating Radar (GPR) investigation method has been developed in the 90's by several companies, but the Italian IDS (*Ingegneria dei Sistemi*) provide the most performing systems for the evaluation of the location and depth of these networks. Additional electromagnetic methods developed by Leica Geosystems allow for the identification of the different kinds of networks (electrical, communication, etc.).

The combination of these two methods enables us to locate (in x, y and z) and to identify the underground networks with the best accuracy.

1. Ground Penetrating Radar

GPR is the geological application of RADAR (Radio Detecting And Ranging) with following characteristics:

Antenna: frequencies from 10 MHz to 2 GHz according to investigation depth.

Reach: from few centimeters to several meters deep.

Resolution: centimetric

Signal: weakened and turned only towards the soil. There isn't any harmful effect on the manipulator.

Used for various applications thanks to "road" and "all-land" configurations.

Figure 1 - GPR detection campaign (Reunion)

GPR principle is relatively basic: a transmitter generates a short electromagnetic impulsion (few nanoseconds) via an antenna laid on the ground. The energy reflected by any underground target is received by a reception antenna that is moved along the prospecting surface. Both antennas move at the same time. This signal is displayed in real time on a laptop as a soil cross section. Data is recorded and processed by specialized software.

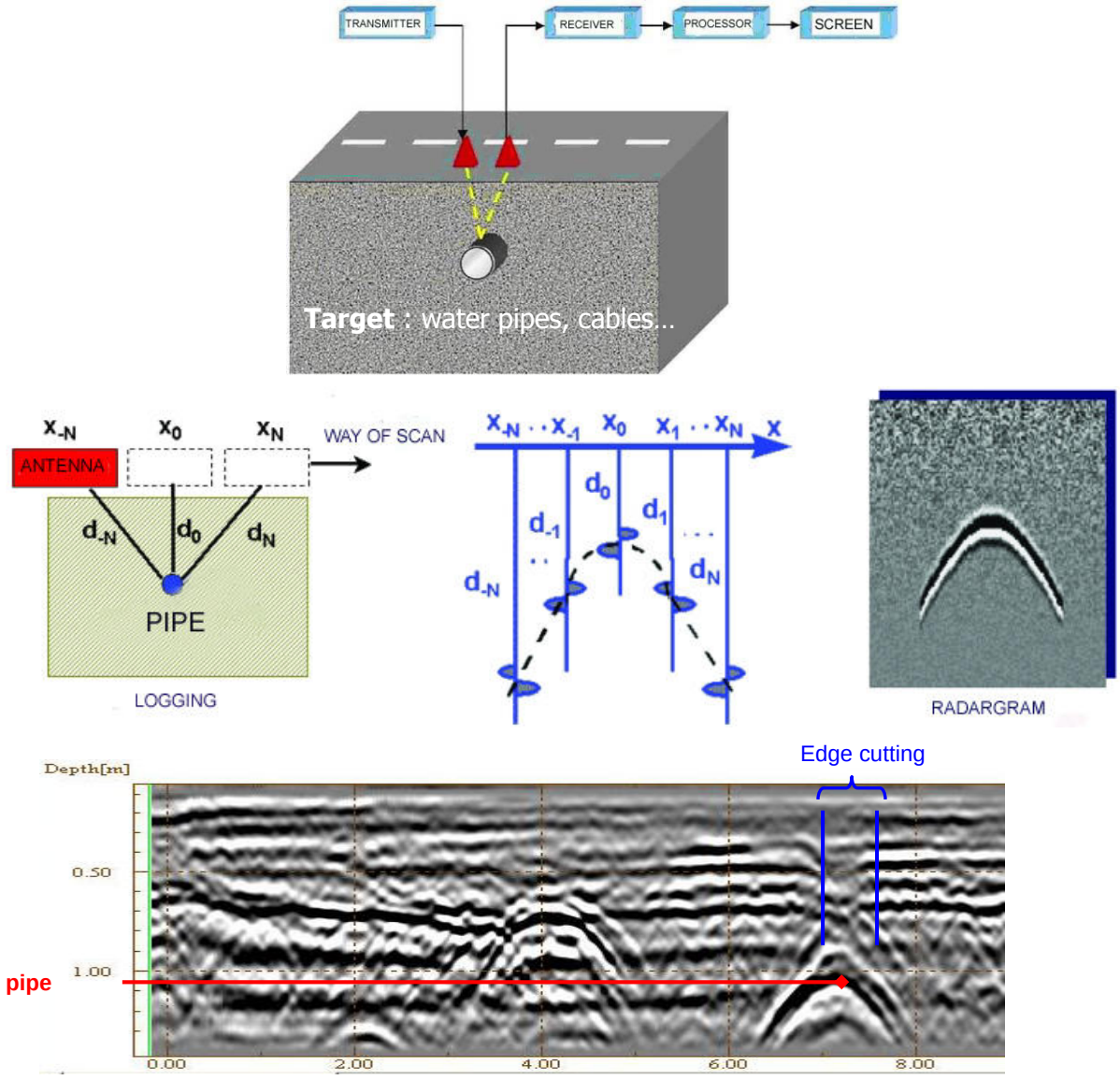

Figure 2: GPR principle and radargram

Target depth and position are given simply by reading coordinates of hyperbolic curve that appears on the radargram. However, because of the high number and the complexity of targets, the analysis of GPR data has to be executed by skilled engineers.

The estimation of propagation velocity is necessary to improve accuracy. It is made by a calibration on a depth known object or with a numeric model of velocity when it is not possible.

STRATAGEM974 - 62 Bd du Chaudron - 97490 Ste Clotilde – Reunion Island
Tel/fax: +262 262 21 84 69 - GSM: +262 692 26 60 62 / +262 692 36 96 50
Email: contact@stratagem974.com

2. IDS innovations

In the 90's, the Italian company IDS (*Ingegneria dei Sistemi*) developed its own GPR equipment by axing on 3 main aspects:

1. to improve system architecture and mechanism by incorporating accurate multichannel antennas,
2. to reduce human factor effect on results reliability by developing a specialized software,
3. to automate calibration procedures in order to improve productivity.

IDS system gives buried target position and depth with the best accuracy and a short calibration time. Acquired data can be displayed in 2D or 3D view.

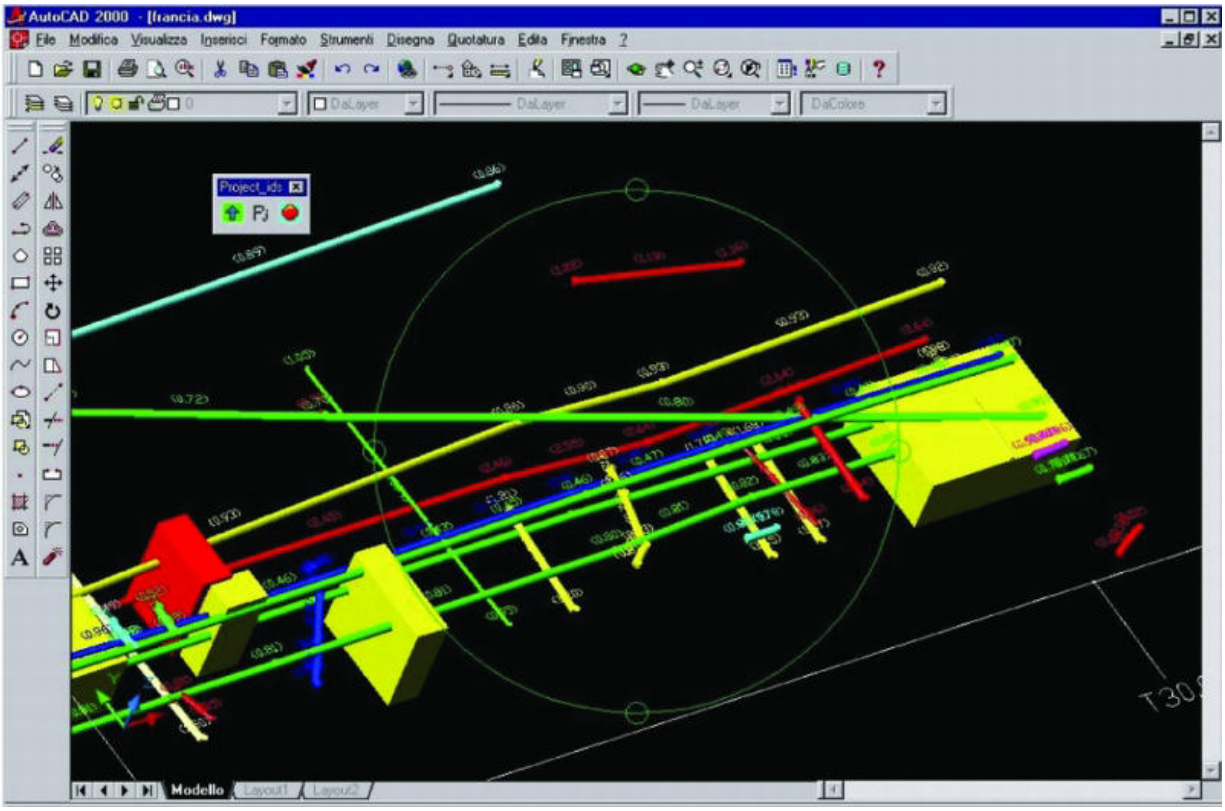

Figure 3: Coupling IDS results with AutoCAD software

STRATAGEM974 - 62 Bd du Chaudron - 97490 Ste Clotilde – Reunion Island
Tel/fax: +262 262 21 84 69 - GSM: +262 692 26 60 62 / +262 692 36 96 50
Email: contact@stratagem974.com

3. Electromagnetic methods

LEICA Geosystems detector locates buried network or walled up cables in concrete (an option is dedicated to detect electrical cables in building). Signals existing in cables can be detected directly thanks to the receiver (figure 4).

Figure 4 : receiver

Figure 5 : transmitter bi frequency 8/33 kHz

For installations that don't send out any signal, the transmitter system (figure 5):

1. can inject an electrical current on any conductive access point (figure 6).
2. can inject an electromagnetic signal by a loop placed on a pipe or an electrical cable (figure 7).
3. can generate an induced current on a pipe or an underground cable, when a direct connection is not possible (figure 8).

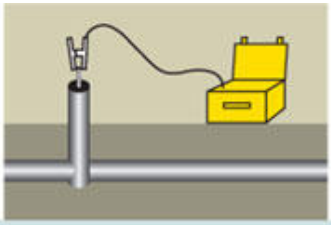

Figure 6 :
Direct connection

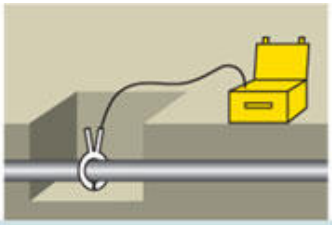

Figure 7 :
Use of a signal loop

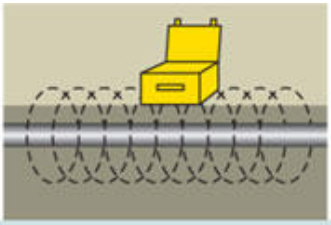

Figure 8 :
Induction

Conclusion

Electromagnetic methods are used for buried electrical cables detection and so have a defined field of action. GPR is dedicated to any buried targets and IDS system is the most performing and ergonomic in the present marketplace. It has widely proved its efficiency in Europe and Reunion Island with more than 150 km of investigation achieved by our staff since 2007.

STRATAGEM974 - 62 Bd du Chaudron - 97490 Ste Clotilde – Reunion Island
Tel/fax: +262 262 21 84 69 - GSM: +262 692 26 60 62 / +262 692 36 96 50
Email: contact@stratagem974.com

Our Main References

More than 150 km of buried pipes and cables has been achieved by Stratagem974 to date in various projects:

- updating of the Port naval base network map, Reunion Island (Graniou OI, Vinci, 2007-2008)
- installation of optic fibre in eastern and western territories of Reunion Island (Graniou OI, Vinci, 2007-2008)
- network map checking, St Denis, le Port, St Pierre of Reunion Island (Sogetrel, 2009)
- buried pipes detection for the Tram-Train project (Regional Council Reunion, 2008-2009)
- updating of network map of a military area, Sainte Clotilde, Reunion Island (French army, 2009)
- large scale sewage pipe detection and update of network map (**Cycléa**, 2010)
- buried networks detection in a densely urbanized area before the installation of optic fibre networks (**Sogetrel**, 2010)
- network map verification before the realisation of public works in urban areas (**Ouest BTP**, 2010)
- detection of buried networks (**CCI-Gillot airport zone**, 2010)
- detection of buried networks before the installation of buried sewage systems (**EPE Reunion**, 2010)
- detection of buried structures, Le Port (**Eiffage TP**, 2010-2011)

IDS INGEGNERIA DEI SISTEMI

Leica Geosystems

STRATAGEM974 - 62 Bd du Chaudron - 97490 Ste Clotilde – Reunion Island
Tel/fax: +262 262 21 84 69 - GSM: +262 692 26 60 62 / +262 692 36 96 50
Email: contact@stratagem974.com